Access DB# 111446

SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: ERIC COMPTON Examiner #: 77132 Date: 1/6/04
Art Unit: 3726 Phone Number 305-0240 Serial Number: 10/069,384
Mail Box and Bldg/Room Location: CP2 5A13 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

****

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: NITINOL BALL BEARING ELEMENT AND PROCESS FOR MAKING

Inventors (please provide full names): JULIEN GERALD

Earliest Priority Filing Date: 8/19/1999

***For Sequence Searches Only* Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.**

BALL BEARING + NITINOL (SHAPE-MEMORY ALLOY)
ROLLER BEARING

RACE ELEMENT

AMENDED / CLAIM 20, CLAIM 9 / Secondarily & RACE OR BALL

See attached "amended claims"

****

STAFF USE ONLY	Type of Search	Vendors and cost where applicable
Searcher: EMONY DAMRON	NA Sequence (#)	STN ✓ 217.70
Searcher Phone #: 3058587	AA Sequence (#)	Dialog ✓ 670.48
Searcher Location: CP2 2C8	Structure (#)	Questel/Orbit
Date Searcher Picked Up: 1/6/04 (10AM)	Bibliographic ✓	Dr.Link
Date Completed: 1/6/04 (315PM)	Litigation ✓	Lexis/Nexis
Searcher Prep & Review Time: 120 MIN	Fulltext	Sequence Systems ✓
Clerical Prep Time: 0	Patent Family	WWW/Internet ✓
Online Time: 165 MIN	Other	Other (specify)

PTO-1590 (8-01)

STIC Search Report
EIC 3700

STIC Database Tracking Number: 111446

TO: Eric Compton **Location: cp2 5a13** **Art Unit: 3726** **Tuesday, January 06, 2004** **Case Serial Number: 10/069384**	**From: Emory Damron** **Location: EIC 3700** **CP2-2C08** **Phone: 305-8587** **Emory.Damron@uspto.gov**

Search Notes

Dear Eric,

Please find below an inventor search in the bibliographic and full-text foreign patent files, as well as keyword searches in the patent and non-patent literature files, both bibliographic and full text.
References of potential pertinence have been tagged, but please review all the packets in case you like something I didn't.
In addition to searching on Dialog, I also searched Google, EPO/JPO/Derwent, and STN.

Please contact me if I can refocus or expand any aspect of this case.

Happy New Year!

Sincerely,
Emory Damron
Technical Information Specialist
EIC 3700, US Patent & Trademark Office
Phone: (703) 305-8587/ Fax: (703) 306-5915
Emory.damron@uspto.gov

STIC Search Results Feedback Form

EIC 3700

Questions about the scope or the results of the search? Contact ***the EIC searcher or contact*:**

John Sims, EIC 3700 Team Leader
308-4836, CP2-2C08

Voluntary Results Feedback Form

- *I am an examiner in Workgroup:* ☐ *Example: 3730*
- *Relevant prior art **found**, search results used as follows:*
  - ☐ 102 rejection
  - ☐ 103 rejection
  - ☐ Cited as being of interest.
  - ☐ Helped examiner better understand the invention.
  - ☐ Helped examiner better understand the state of the art in their technology.

Types of relevant prior art found:

- ☐ Foreign Patent(s)
- ☐ Non-Patent Literature
  (journal articles, conference proceedings, new product announcements etc.)

- *Relevant prior art **not found:***
  - ☐ Results verified the lack of relevant prior art (helped determine patentability).
  - ☐ Results were not useful in determining patentability or understanding the invention.

Comments:

Drop off or send completed forms to STIC/EIC3700 CP2 2C08

sira Search and Information Resources Administration

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=> d his

     (FILE 'HOME' ENTERED AT 14:21:38 ON 06 JAN 2004)

     FILE 'ALUMINIUM, HCAPLUS, MATBUS, METADEX, EMA, AEROSPACE, CONFSCI,
     RUSSCI' ENTERED AT 14:22:30 ON 06 JAN 2004
L1         36435 S NITINOL OR SHAPE MEMORY OR SHAPEMEMORY OR NITI OR NI TI OR TI
L2         42379 S SMA OR SMM OR SME OR MARTEN? (5N) AUSTEN? OR TINI OR TI NI
L3         69592 S L1-L2
L4          7800 S BALL BEARING? OR BEARING BALL? OR RACE BEARING? OR BEARING RA
L5          5857 S ROLLER BEARING? OR NEEDLE BEARING? OR BEARING CAGE? OR CAGE B
L6         12648 S L4-L5
L7            96 S L3 AND L6
L8            90 S L7 AND PY<=2000
L9            79 DUP REM L8 (11 DUPLICATES REMOVED)
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L9 ANSWER 4 OF 79 AEROSPACE COPYRIGHT 2004 CSA on STN
ACCESSION NUMBER: 2002:007231 AEROSPACE
DOCUMENT NUMBER: A98-36400
TITLE: **Shape memory** wire as a drive mechanism for a Fourier transform spectrometer
AUTHOR(S): Brasunas, John, (NASA, Goddard Space Flight Center, Greenbelt, MD)
SOURCE: Optical Engineering, (**Jun 1998**) vol. 37, no. 636908, pp. 1882, 1883. Refs: 4. Available from: Aeroplus Dispatch.
ISSN: 0091-3286
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal
LANGUAGE: English

AB This paper examines the use of **shape memory** wire as a potentially much lighter and cheaper alternative to the voice-coil motor of a Fourier transform spectrometer (FTS). For instance, **Flexinol** , which is manufactured by Dynalloy, Inc., of Irvine, CA, is a shape (length) memory alloy actuator wire made of nickel and titanium. When prestretched at room temperature and then electrically driven (heated), it contracts. The alloy changes its internal structure at a transition temperature (typically set at 70-90 C). The contraction during heating may be as great as a few percent. The wire can then be stretched again when cooled, and this can be repeated many times. The motion (stroke) of the memory wire is set by the stress one uses to stretch the below-transition wire. For 10,000-psi loading, the stroke is about a four-percent stretch. For 0.010-in.-diameter **Flexinol**, the maximum pull is 930 g. In comparison, the voice-coil motor may supply a force up to one lb. A servo-controlled FTS experimental setup using 30 cm of 0.010-in.-diameter **Flexinol** as a **shape memory** wire drive is demonstrated. The results show that for the same FTS servo network, tachometer, and **ball-bearing** slide, the memory wire drive has a speed variation that is about a factor of two worse than the voice-coil drive. This is, nevertheless, a respectable performance, since a 9.5-percent speed variation for such a low speed as 55-micron/s is still useful for Fourier transform spectroscopy.

TI **Shape memory** wire as a drive mechanism for a Fourier transform spectrometer

SO Optical Engineering, (**Jun 1998**) vol. 37, no. 636908, pp. 1882, 1883. Refs: 4. Available from: Aeroplus Dispatch.
ISSN: 0091-3286

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CT *SHAPE MEMORY ALLOYS; *FOURIER TRANSFORM SPECTROMETERS; *ELECTRIC WIRE; TACHOMETERS; SERVOCONTROL

L9 ANSWER 17 OF 79 HCAPLUS COPYRIGHT 2004 ACS on STN DUPLICATE 2
ACCESSION NUMBER: 1991:86383 HCAPLUS
DOCUMENT NUMBER: 114:86383
TITLE: Application of isothermal martensite in GCr15 **ball-bearing** steel
AUTHOR(S): Xu, Zuyao; Chen, Yexin; Chen, Weiye
CORPORATE SOURCE: Shanghai Jiaotong Univ., Shanghai, Peop. Rep. China
SOURCE: Gangtie (**1990**), 25(6), 47-50
CODEN: KATIAR; ISSN: 0449-749X
DOCUMENT TYPE: Journal
LANGUAGE: Chinese

AB Isothermal **martensite** promotes stabilization of retained **austenite** in the quenched GCr15 **ball-bearing** steel upon cooling to subzero temperature, cycling of compressive stress, and aging at room temperature Retained **austenite** was induced to transform to **martensite** under stress cycling to increase the contact fatigue life. Isothermal **martensite** stabilizes retained **austenite** and results in beneficial transformation-induced plasticity. The contact fatigue life of steel parts isothermally treated with a few percentages of isothermal martensite is 36% higher than that after subzero treatment and 18% higher than that treated by normal quenching and tempering. The dimensional stability of specimen treated isothermally is higher than that of specimens treated by normal quenching and tempering by 34%. The accommodation deformation induced by the isothermal martensite transformation leads to the mech. stabilization of retained austenite.

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CODEN: KATIAR; ISSN: 0449-749X

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IT 12173-93-2P, Martensite, preparation
RL: FORM (Formation, nonpreparative); PREP (Preparation)
(formation of, isothermal, in **ball-bearing** steel, fatigue properties in relation to)

L9 ANSWER 42 OF 79 METADEX COPYRIGHT 2004 CSA on STN
ACCESSION NUMBER: 1986(6):12-732 METADEX
TITLE: The Influence of Cyclic Tempering on the Structure of **Ball-Bearing** Steels.
AUTHOR: Ignat, C.
SOURCE: Cercet. Metal. (**1983**) 24, 335-340
DOCUMENT TYPE: Journal
LANGUAGE: Romanian

AB The effect of cyclic tempering on the relative amounts of residual **austenite, martensite** and carbide is investigated in **ball-bearing** steels. The carbide size, density and distribution variation by groups of dimensions is also reported. A thorough analysis of the results together with optic and electronic microscopy based observations enable one to conclude that cyclic tempering on the above-mentioned steels is a feasible technology for increasing size stabilization. 4 reference-AA

TI The Influence of Cyclic Tempering on the Structure of **Ball-Bearing** Steels.
SO Cercet. Metal. (**1983**) 24, 335-340

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L9 ANSWER 44 OF 79 METADEX COPYRIGHT 2004 CSA on STN
ACCESSION NUMBER: 1983(10):61-616 METADEX
TITLE: System for Train Accident Reduction-DOT STAR.
AUTHOR: Richardson, J.J.
NUMBER OF REPORT: NBS Spec. Publ. 652
SOURCE: National Bureau of Standards. Washington, D.C. 20234. **1983**. 132-145. Accession Number: 83(10):72-537 Conference: Damage Prevention in the Transportation Environment, Gaithersburg, Md., 21-23 Oct. 1981
DOCUMENT TYPE: Conference; Report
LANGUAGE: English

AB The Dept. of Transportation-System for Train Accident Reduction (DOT STAR) study at the Naval Surface Weapons Center (NSWC) is developing a prototype system to help reduce the number of train accidents. NSWC has taken military technology and applied it to develop an on-train anti-derailment system. This system can sense a local derailment or a hot bearing. Upon sensing these conditions, the system automatically applies emergency braking. Exploratory development hardware of the journal bearing thermal sensor successfully completed > 100 000 miles of travel. A **roller bearing** thermal sensor has also been designed. **NITINOL** is the key component used to sense overheated bearings. The derailment detector uses the impact of a sensor foot with the rail head to sense a local derailment. Upon generation of a hot box or a local derailment, the sensors initiate a thermal pulse battery. The electrical pulse activates the air valve which applies the train's brakes.-AA

NR NBS Spec. Publ. 652

SO National Bureau of Standards. Washington, D.C. 20234. **1983**. 132-145. Accession Number: 83(10):72-537 Conference: Damage Prevention in the Transportation Environment, Gaithersburg, Md., 21-23 Oct. 1981

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CT Railroad cars; **Roller bearings**: Service life; Journal bearings: Service life; **Shape memory**; Safety; Sensors; Fatigue failure; Temperature measurement

L9 ANSWER 64 OF 79 HCAPLUS COPYRIGHT 2004 ACS on STN
ACCESSION NUMBER: 1967:31211 HCAPLUS
DOCUMENT NUMBER: 66:31211
TITLE: Suitability of high-temperature resistant nickel-chromium alloys for dies for the extrusion of steel
AUTHOR(S): Jahn, Thomas; Gaertner, Gerhard
SOURCE: Neue Huette (**1966**), 11(11), 680-4
CODEN: NEUHAM; ISSN: 0028-3207
DOCUMENT TYPE: Journal
LANGUAGE: German

AB The high temps. and pressures (100 kg./mm.2) involved in extruding hot steel cause severe tool and die wear. High hot tensile strength, yield strength, resistance to wear and tear, and ductility are important properties for dies. An alloy with 8-10% W was worn out after 20-60 extrusions. Expts. were conducted with the wrought alloy LW 2325 containing C 0.10, SiO 42, Mn 0.26, Cr 15.68, W 5.25, Mo 1.38, Al 2.14, Ti 1.58, and Fe 1.68%, S, P, Cu, Ce, and B traces, and the balance Ni, HRC (Rockwell C Hardness) 39 as received and 31 after solution treatment and aging; LW 2326 with C 0.18, Si 0.34, Mn 0.39, Cr 14.91, W 1.39, Al 4.35, and Fe 1.68%, S, P, Cu, Ce, B, and Sb traces, and the balance Ni with resp. HRC 30 and 18; the Ni-Cr cast alloy I (C 0.13, Mn 0.47, Cr 12.04, Mo 2.80, Ti 1.76, Fe 4.8%, and the balance Ni (HRC 39, as received); and cast alloy II (C 0.24, Mn 0.32, Cr 11.92, Mo 2.25, Ti 1.68, Fe 6.7%, and the balance Ni) with HRC 39, as received). The die had a sleeve of W alloy and an insert of Ni-Cr alloy which can be changed after wear. **Ball bearing** tubes were extruded with outside diameter 23.6 mm., inside diameter 14.2 mm., and length 2.8 m. Billets with 73 mm. outside diameter, 16 mm. inside diameter, and 210 mm. length were used. The billets were preheated at 1100° in a salt bath. A 500 + 106 g. hydraulic extrusion press with a ram speed of 300 mm./sec. was considered. The change in cross section was 93%. The most reliable alloy was LW 2325 as received, which survived ≤400 extrusions. Aged dies of LW 2325 were too soft and survived ≤160 extrusions. Dies of 30 WCrV 34.11 survived ≤13 extrusions, of aged LW 2326 ≤285, cast alloy I ≤173, and cast alloy II ≤88 extrusions. LW 2325 was also suitable for extruding small steel profiles.

SO Neue Huette (**1966**), 11(11), 680-4
CODEN: NEUHAM; ISSN: 0028-3207

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ST DIES STEEL EXTRUSION; **BALL BEARING** TUBES; STEEL EXTRUSION DIES

IT Tungsten alloys, containing
(aluminum-chromium-iron-molybdenum-**nickel-titanium**-
and aluminum-chromium-iron-nickel-, for dies for extrusion of steel)

IT Molybdenum alloys, containing
(aluminum-chromium-iron-**nickel-titanium**-tungsten-
and chromium-iron-**nickel-titanium**-, for dies for
extrusion of steel)

IT Iron alloys, containing
(aluminum-chromium-molybdenum-**nickel-titanium**
-tungsten- and aluminum-chromium-nickel-tungsten- and
chromium-molybdenum-**nickel-titanium**-, for dies for
extrusion of steel)

IT Chromium alloys, containing
(aluminum-iron-molybdenum-**nickel-titanium**
-tungsten-, aluminum-iron-nickel-tungsten-, and iron-molybdenum-
nickel-titanium-, for dies for extrusion of steel)

IT Aluminum alloys, containing
(chromium-iron-molybdenum-**nickel-titanium**
-tungsten-, and chromium-iron-nickel-tungsten-, for dies for extrusion
of steel)

L9 ANSWER 65 OF 79 HCAPLUS COPYRIGHT 2004 ACS on STN
ACCESSION NUMBER: 1966:25760 HCAPLUS
DOCUMENT NUMBER: 64:25760
ORIGINAL REFERENCE NO.: 64:4708a-c
TITLE: Producing compressive stress in the surface layer of hardened steel
INVENTOR(S): Koistinen, Donald P.
PATENT ASSIGNEE(S): General Motors Corp.
SOURCE: 5 pp.; Division of U.S. 3,117,041
DOCUMENT TYPE: Patent
LANGUAGE: Unavailable
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
US 3216869		19651109	US	19630429 <--

AB Steel articles hardenable to their centers are hardened to leave their surfaces in compression to improve the fatigue resistance, by altering either the composition or the austenitizing temperature of the surface of the article compared to the interior so that the transformation temperature of **austenite** to **martensite** is lower at the surface. Then in quenching, martensite is formed 1st in the interior where the resulting volume change occurs while the surface layer is plastic, and when the surface transforms later and expands, the interior is hard and resists further expansion, producing compressive stress at the surface. Steels containing 0.95-1.1% C and 1.3-1.6% Cr, commonly used for hardened **ball bearings**, is specially suitable for this process. Such a steel ball can be austenitized throughout at 1450°F., and subsequently heated briefly to 1900°F. so that only the surface layer is affected, before the entire ball is quenched in oil. At about 500°F. the interior transforms to hard martensite, while the surface layer does not transform until the ball temperature falls to 250°F. when compressive stress results from its expansion. The same result can be obtained with a single 30-min. austenitizing at 1575°F. in an atmospheric containing 5% NH3, when N diffuses into the surface layer to a depth of about 0.015 in. On quenching in oil, martensite forms at a lower temperature in the nitrided layer than in the interior. By treating with N for 5-10 hrs. at 975-1050°F., the layer stressed in compression on quenching was thickened to 0.045 in. Cr, Ni, or B can be applied to the surface and diffused inward to obtain the same effect as with N on hardening.

PI US 3216869 **19651109**

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI US 3216869		19651109	US	19630429 <--

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IT **Bearings**

(**ball**, with compressive surface stress)

L9 ANSWER 68 OF 79 HCAPLUS COPYRIGHT 2004 ACS on STN
ACCESSION NUMBER: 1964:402543 HCAPLUS
DOCUMENT NUMBER: 61:2543
ORIGINAL REFERENCE NO.: 61:375f-h,376a
TITLE: Complete transformation of austenite in hardened high-carbon steel
INVENTOR(S): Mantel, Edward R.
PATENT ASSIGNEE(S): General Motors Corp.
SOURCE: 3 pp.
DOCUMENT TYPE: Patent
LANGUAGE: Unavailable
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
US 3131097		19640428	US	19620223 <--

AB High-C Cr steel roller and **ball bearings** are hardened and tempered with dimensional stability, no retained austenite, and hardness maintained at 62-3 Rockwell C, by quenching in oil at 90-100°F. from 1750-1825°F., re-austenitizing at 1550-1600°F. and similarly quenching, immediately refrigerating 2 hrs. at -110°F., warming slowly, and tempering at 400-500°F., preferably for 4 hrs. at 400, 4 hrs. at 450, and 2 hrs. at 500°F. Double austenitizing and quenching give a finer structure, higher-C martensite, and greater strength, and with the cold treatment permit higher tempering, to transform all the retained austenite, without dimensional change or softening. When test bars 0.25 + 0.5 + 0.75 in. of steel containing C 1.01, Mn 0.34, Si 0.26, Ni 0.12, Cr 1.41, Mo 0.02, S 0.02, and P 0.008% were so treated, first 30 min. at 1800°F., then 1 min in oil at 95°F., 30 min. at 1575°F., 1 min. in the oil again, and within 1 min. cooled to -110°F. for 2 hrs. and tempered 10 hrs. as stated above, the hardness was 62.5 Rockwell C, precision elastic limit by foil strain gage 88,000 lb./in.2 and tensile strength 314,000327,000 lb./in.2 Specimens conventionally heat treated and containing 2-3% retained austenite had 44,000 lb./in.2 elastic limit and 59-60 Rockwell C hardness.

PI US 3131097 **19640428**

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI US 3131097		19640428	US	19620223 <--

AB High-C Cr steel roller and **ball bearings** are hardened and tempered with dimensional stability, no retained austenite, and hardness maintained at 62-3 Rockwell C, by quenching in oil at 90-100°F. from 1750-1825°F., re-austenitizing at 1550-1600°F. and similarly quenching, immediately refrigerating 2 hrs. at -110°F., warming slowly, and tempering at 400-500°F., preferably for 4 hrs. at 400, 4 hrs. at 450, and 2 hrs. at 500°F. Double austenitizing and quenching give a finer structure, higher-C martensite, and greater strength, and with the cold treatment permit higher tempering, to transform all the retained austenite, without dimensional change or softening. When test bars 0.25 + 0.5 + 0.75 in. of steel containing C 1.01, Mn 0.34, Si 0.26, Ni 0.12, Cr 1.41, Mo 0.02, S 0.02, and P 0.008% were so treated, first 30 min. at 1800°F., then 1 min in oil at 95°F., 30 min. at 1575°F., 1 min. in the oil again, and within 1 min. cooled to -110°F. for 2 hrs. and tempered 10 hrs. as stated above, the hardness was 62.5 Rockwell C, precision elastic limit by foil strain gage 88,000 lb./in.2 and tensile strength 314,000327,000 lb./in.2 Specimens conventionally heat treated and containing 2-3% retained austenite had 44,000 lb./in.2 elastic limit and 59-60 Rockwell C hardness.

IT 12173-93-2, **Martensite**
(formation, from residual **austenite** in steel for bearings)
IT 12244-31-4, **Austenite**

(residual or retained, **martensite** formation from, in steel for bearings)

L Number	Hits	Search Text	DB	Time stamp
5	20	(shape adj memory) same (ball adj bearing$ or ballbearing$)	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/01/06 11:00